MIRAMICHI RIVER ENVIRONMENTAL ASSESSMENT COMMITTEE

INTERIM REPORT

June 5, 1990

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EXECUTIVE SUMMARY

This Interim Report marks the mid point of the Committee's two year effort to provide a collective assessment of the present environmental quality of the Miramichi River System, identify the factors impacting the River and finally to make recommendations to those concerned with the River on what steps can be taken for its preservation and enhancement for the long term benefit of all.

This report contains what the Committee has done to date, what it has found, and what is planned for the next year. The report also contains general information on the river system, water pollution and legislation. The work to date consists primarily of a water quality assessment project done in 1989/90 on the freshwater reaches of the River down to the Enclosure Park near the junction of the freshwater with the salt water estuary, collection of existing data on the River, identification of all the potential sources of pollution, and planning for the field work to be done in summer 1990.

Through a water testing program, and examination of life forms in the river sediments it has been concluded that the environmental quality of the River is excellent in the headwaters, begins to show some moderate stresses as it passes through Doaktown and Blackville, and shows very serious impacts in the area of the Enclosure Park. This last area receives all tidal backwash from the more populated and industrialized estuary area. The impacts noted were not so evident in water quality measurements. This area and the whole estuary will be the primary focus for the Committee during the coming summer.

In addition to actual in-river work to be done, the Committee will be obtaining information on approximately 70 potential sources of pollution on the River from a summer survey program in cooperation with the NB Department of the Environment and Environment Canada.

Much of the effort to qualify the health of the estuary will be directed at examining the fish and shellfish for possible chemical pollutants. More difficult to assess than this will be the impacts of various non-chemical impacts which may change the habitat, migration, or reproductive stresses on the various species.

The Committee is not expecting to provide all the answers in their final report in May 1991, but does anticipate being able to make some definite statements on environmental quality, pollution impacts and most important FUTURE DIRECTIONS FOR RIVER IMPROVEMENT.

The Committee has established a mailing address (MREAC, Box 715, Newcastle,NB E1V 3V4) and phone message centre (622-6499) and welcomes any comments on the project. Comments can also be passed to any Committee members.

PART I

1.0 INTRODUCTION

The Miramichi River and Estuary has continued to support a diversity of economic interests. The forest industry has had a strong presence in this region for several hundred years. Fishing, both commercial and recreational, has been of long standing interest to the economic well-being of many residents of the Miramichi. In more recent years, the exploration and extraction of base metals has also become of significance.

The Miramichi system, however, provides more than economic interest, the system provides a lifestyle to the estimated 50,000 people living in the watershed. The river and estuary have played a significant role in transportation, communications, food supply, recreation, water supply and the establishment of villages, towns and ports along its shore. Now, we are at a point where large numbers of people live here and work in industries and water-related activities close by.

All this activity and effort has resulted in growth and diversity on the Miramichi. Land use patterns are changing and growing; industry is expanding; resource use is increasing; and energy consumption is rising. When one begins to consider what the overall impact might be with the integration of all these changes, there are no immediately available answers. There are pieces to these answers if one looks at existing information on the individual sources of pollution; however, a better insight into the overall state of the environment is currently lacking.

The Miramichi River Environmental Assessment Committee was formed through the interests of several concerned citizens of the Miramichi. This interest was expanded and extended to all levels of government, interest groups, industry and labour with the result, on April 18, 1989, the committee became operational. The diverse membership on the committee has resulted in equally diverse points of view and the need to gain an appreciation of each others points of view. The common goal of the quality of the Miramichi River is the link which has over the past year allowed the members on the committee to develop a situation where they can learn and talk together.

The terms of reference for the committee are to assess the environmental quality of the Miramichi watershed over a two year time frame. The study will also identify and quantify the point and non-point sources of pollution and attempt to determine what may, or does, impact the quality of the river, the sediments, and aquatic life.

The boundary of the study area extends from the headwaters of the contributing streams to the barrier islands at the eastern edge of the Miramichi Inner Bay and slightly beyond. This encompasses an estuarine area of some 300 square kilometres and river basin drainage area of some 14,000 square kilometres. The committee is supported to date by contributions from local industry, municipalities, and interest groups, along with technical and administrative support from the provincial and federal governments. The information from this study will attempt to address as many of the concerns expressed by the committee as are possible within this time-frame and to the extent that resources permit. The major effort in terms of field work in 1989 was dedicated to the evaluation of water quality in the freshwater river system and will be the main emphasis of this interim report. In 1990 a continuation of this freshwater work will continue with the estuarine area being the primary focus of new efforts.

2.0 GLOSSARY

This glossary is organized according to the order the terms appear in the report. The explanations are meant to provide easy understanding and may not be as would be found in a text book.

base metals-	refers to a group of metals commercially mined and includes such as zinc, copper and lead
point source-	a source of pollutants which originates from a fixed point such as a pipe or ditch
non-point source-	a source of pollutants which originates from a diverse area such as fertilizer runoff from a farming district
estuarine-	section of a water body which is between the definitely freshwater and definitely saltwater environments. These areas are highly productive biologically and very important to many species.
benthic invertebrates-	bottom dwelling creatures in fresh or salt water which are relatively immobile and have no backbone such as worms and larvae of flies
heavy metals-	chemically similar family of metals ex. arsenic,copper,cadmium,chromium,lead, mercury,nickel,and zinc
organic chemicals-	a group of chemicals having a carbon based structure. Living things, residues of living things such as petroleum and man made chemicals based on a carbon structure
inorganic chemicals-	a group of chemicals not having a carbon based structure such as minerals or water
PAH-	short form for polynuclear aromatic hydrocarbons(a family of chemicals). Naturally occurring in coal and oil. An organic chemical. Used as a pesticide for coating wood in the form of creosote.
PCB-	short form for polychlorinated biphenyls(a family of chemicals). Not naturally occurring. Used in electrical equipment for insulating and fire resistant properties.
PCP-	short form for pentachlorophenol. Not naturally occuring. Used as a pesticide for coating wood. example: Pentox
biota-	any living organism; man, fish, bugs
parameter-	scientific name for tests to be done; example chloride and temperature are two parameters that could be done in a water quality investigation
nutrient-	a chemical which contributes to the growth of an organism but usually refers to phosphorus and nitrogen based chemicals
dissolved oxygen-	fish and other aquatic species extract oxygen which is dissolved in the water to live. Levels range from 0 to 12 mg/l or parts per million depending on temperature and what else is in the water and being eaten by bacteria. The bacterial processes use oxygen in competition with the fish.
assimilative capacity-	the ability of a water system to absorb incoming stresses(waste) from natural or man-made sources and still maintain a healthy population of biota

substrate geology-	the rocks and minerals which surround the watercourse and contributed to the materials on the stream bottom
organic loading-	the amount of organic material (uses oxygen when it decays) from natural or man-made sources being put into a watercourse
pH-	a numerical measure of the acid or alkali content of water with a scale of 0 (most acid) to 14 (most alkali). Most water is near neutral (7.0). pH=6.0 is 10 times more acid than 7.0. pH=5.0 is 100 times more acid than 7.0.
fecael coliforms-	Actually fecael coliform bacteria. An easy test used to indicate the possible presence of disease causing bacteria or viruses because they are excreted in the feces of warm blooded animals . They do not cause disease themselves.
phosphorus-	A nutrient which is necessary for growth of green plant material such as grasses on land or alge in water
nitrogen-	A nutrient which is necessary for growth of green plant material such as grasses on land or alge in water
soft-	Soft water is low in calcium and magnesium content. Lake and river water is softer than groundwater
buffered-	well buffered water contains sufficient natural minerals to prevent pH changes due to acid rain or other natural acid sources
sedimentation-	the process of silt and other fine materials settling out in streams, rivers and lakes in quiet areas
tolerent species-	species which can survive in more hostile environments such as low dissolved oxygen, abnormal pH, high temperature, etc
hardness-	Hard water is high in calcium and magnesium content. Groundwater is harder than surface water.
dissolved organic carbon (DOC) -	a way of measuring the organic material in a water sample. The DOC will be from decaying material and a measure of the loading on the water system
TKN-	Total Kjeldahl Nitrogen. A measure of the nitrogen in a sample in all its forms ammonia,nitrates and organic nitrogen
pristine environment-	an environment not impacted by man or natural disasters
topography-	the measure of the elevation of the land above sea level

3.0 THE MIRAMICHI - THEN AND NOW - CHANGES IN 30 YEARS

The year 1990 shows that many changes have occurred in 30 years. Lifelong residents talk of favorite swimming and picnic areas they frequented as children. They describe the joy of fishing in the river either by boat or from favorite ponds along the Miramichi system. Digging clams on Portage Island and Baie du Vin Island is still a favorite pastime but the clams seem to be reduced in number and quality.

What has happened to the swimming area at the Enclosure?

Some of the changes on the river system over the last 30 years will be a result of pollution of various types, some will be due to new ways of doing things, some due to being able to find problems that were not detected before.

Listed below are a few examples of things that have changed on the river in this period of time. The committee hopes that readers who have other examples will provide them for consideration. The examples from local residents can be helpful in suggesting where to look or what to look for or just help explain what has already been found.

Example 1 - **THE ICE RUN** -contributed by Peter McKibbon

In the early 1970's, an old farmhouse belonging to an elderly widow was dismantled at Red Bank on the Northwest Miramichi River. Unfortunately destroyed with it was a rather significant historic document - significant at least to people who had grown up in that locale. Discovered in the ruins of that old homestead was a small pantry door with a record on the inside, possibly deserving a spot in the Provincial Archives. It was here that the 90 year old owner and occupant had meticulously and religiously recorded the dates of the movement of the ice from the Northwest Miramichi every spring for the previous fifty years.

It is perhaps an overstatement to suggest that such a record deserves a place in the archives. Besides, pantry doors simply don't microfilm very well! However, for the people of the era prior to 1970, the "running" of the ice, to which it was always referred, bore a significance based on the importance of the river itself to the local lifestyle.

"What day do ya think she's gonna run"; "Do ya think we'll get a Maypole on her this year? We put three out in 62"; "I seen Will Stewart crossin' her on Saturday. She's good for another couple of days" were questions and comments often heard around Sullivan's store and post office at Red Bank where old-timers and young folk gathered and waited while the mail was being sorted.

All the locals knew that the ice nearly always ran at Red Bank in the last week of April. A trimmed sapling, sometimes bearing a Union Jack, was planted firmly in a large ice cake by some brave soul each day in May the ice remained - a rare occurrence.

Will Stewart, an old-timer from Sunny Corner who trekked the ice to visit his sister in Red Bank, became the local "barometer" who gauged the thickness of the ice and relative safety of crossing. He was the first to make the trip in late fall and the last to do so in spring. No one crossed the ice if Will Stewart wouldn't. Locals related stories, undoubtedly exaggerated, of his crossing practically jumping from cake to cake using an alder as a probe. For years, local pundits had prophesied his demise in a watery grave. He died last year at the age of 88, safe, warm and dry in the local senior citizens home because after all, the river was his friend.

Why were people in those days so attentive to the passing of the ice? Probably because in those days, people moved in much smaller circles. The river was a centre of their lives, be it for pleasure or economic reasons. The river was a vital life-line to their existence. Probably, too, the movement of the ice was the first, true harbinger of spring of a much more practical significance than the returning of the swallows to Capistrano. It signalled the end of a long, often difficult winter.

The running of the ice logically led to other questions and comments such as "Are the smelts up yet? I hear

they're at Mullin's Wharf". "Did ya git a shad yet? Someone said they're soft this year". Coupled with these thoughts was the awakening of the river to other sounds such as the call of the loons, the squawking of the gulls and the put-put of Perley Bryenton's motor boat as it made its way upriver in preparation for the main log drive to the North Esk Boom House, as well as the numerous other small rafts of logs prepared along the river bank.

For other people living close to the river bank or on the flats, the running of the ice created an apprehension brought on by accompanying heavy rains, ice jams, and flooding. Would the family "water closet", the woodshed, or the barn on the meadows be this year's victims?

Youngsters were usually exhilarated by the running of the ice. It conjured up thoughts of angling for black trout that had survived the winter, using a peeled alder branch and a store-bought line. A young lad pondered whether this would be the year he would brave the frigid waters of the river by swimming on the twenty-fourth of May - something only the foolhardy would try. Would this be the year he would jump from the roof of the old covered bridge?

The whole issue of the running of the ice raises the question as to why this occurrence passes unnoticed in 1990? Local people would have to go to their windows to check if asked unexpectedly, "Did the ice run yet?" Why this indifference to what was once considered a seasonal phenomenon which generated such interest, concern and, sometimes, apprehension? Does the river no longer play a role in our society? Is technology the culprit? Has clear cutting upriver destroyed the potential for freshet and flooding and led to a drab, unspectacular melting away of the ice which passes unnoticed. Are we too caught up in the rat race of making a living by other means which do not seem to directly touch on the river to take notice?

The answer lies in all of these and probably more. It almost seems as if the river itself has taken an attitude of indifference to man now that it no longer seems to serve the multi-purposes it once did. It raises no such fuss each spring as it once did, with its high tides, flooding, ice jams, and concomitant excitement. Unfortunately, inattention to the river's natural behaviours can lead to abuse and indifference to its fate in the same way as abandoning an old house usually leads to decay and worst of all, vandalism. While the river doesn't play the exact role in our society it once did, we must recognize its importance in other ways, be it for pleasure boating, swimming, angling, or simply as an attractive sight to view. It is imperative for all, be they young or old, individual or corporate citizen to work to restore and maintain the Miramichi River as a living, vibrant being with the incomparable personality and character it once had.

Example 2 - **SMELT CATCHING IN SOUTH ESK** - contributed by Vernon Goodfellow

I have some vivid memories of spring time in South Esk in the early to mid 50's. Much of my spring time activity centred around the river and the brooks that feed into it. I particularly remember the fun we had catching smelts with our bare hands. All of the small brooks in this area had sizeable runs of smelt though the spring-fed brook that runs through the Mrs. Agnus Goodfellow (now Boyd Carnahan) property was the best. Incidentally, this brook was the site of the first fish hatchery in North America established by the original Goodfellow in South Esk.

As soon as the ice had run out of the river, we kept a sharp eye open for the appearance of smelts in the brooks. Whenever they appeared, the word would go out and we would spend many a cold, wet, happy hour catching smelts.

Our intentions were always to stay dry but progressive dampening of sleeves, pants, etc. from kneeling on the wet bank and plunging our hands into schools of hundred of smelts usually ensured that we were a long way from dry. On a number of occasions, I can recall we gave up any semblance of dryness and just waded into the icy water. In this way, thousands of smelts could be herded into small riffles and pools to be caught by the fist-full.

Today, some forty years later, I still regularly check that brook in spring for smelts, more out of nostalgia than anything else. There still are a few smelts that run into that brook in spring, but their numbers are a small

fraction of what they were back in the 50's. The small pools that in the 50's would be gray with schools of hundreds of smelts, today would only have a few, if any, per pool. Three "checks" in the spring of 1990 have been totally unrewarding - not a single smelt has been seen.

It is doubtful that the terror inflicted on the smelt population by two small boys in the 50's is still being felt today. This must be indicative of some other changes impacting on either the habits or populations of smelts.

Example 3 - **WATER LEVELS** - contributed by Theodore Stewart

The most enjoyable experience a fisherman can have is to stand in pools like Slatey, Cave-in and Overdue, in the early hours of the morning, watch the sun come up over the tree tops and wait for the first fish of the day grab your favourite hook.

Over several decades of fishing I have noticed many changes such as: reduced fish stocks, increased fishing pressures and channel changes due to ice flow or high water. Perhaps the most noticeable and disturbing change is the rapid rise and fall of water levels. A perfect example of this is August, 1989, when high water far exceeded the Spring run-off. As water levels increase, the water becomes dirty, discoloured and fish become disinterested.

In my opinion, the reason for the change is the clear cutting methods employed by our forest industry. Years ago the evergreens held the moisture, therefore, the rise and fall was controlled by nature. Today with fewer trees, rain water has a more direct route to the river system causing a very rapid and extreme change in water levels.

Note: The Committee is undertaking an examination of historical river flow data to address the view expressed here.

4.0 ASSESSMENT STRATEGY AND SCHEDULING

The overall schedule adopted by the Committee is shown at the end of this section.

The objective of the committee is to assess the environmental quality (health) of the Miramichi River which includes the water, sediments and aquatic life in the various sections. A secondary objective is to look at the various sources of pollution which may affect the river.

The assessment of river quality and sources of pollution will be used to make statements about the present state of the river and recommendations for ways in which to protect and improve the quality of the Miramichi.

WORK DONE IN 1989

The freshwater and estuarine (saltwater) sections are radically different environments and require different approaches.

a) FRESHWATER ASSESSMENT

In 1989 the prime emphasis was on the freshwater sections and included water sampling for typical chemicals at about 25 stations shown on Figure 1. Also noted on Figure 1 are 10 of these stations which were inspected for benthic invertebrates (gnats, larvae, etc living in the bottom sediments) during the summer months. The water quality samples give a good indication of the chemical state of the river at that point but only at the time of the sample. The benthic invertebrates are an excellent indicator of the water quality because the kind and number give a trained observer a good view of the quality of water that has been passing the location for a considerable period of time before. This kind of observation will let the scientist know if major changes in water quality have occurred any time in the recent past but are not measureable in water tests now.

In 1990 some follow up water sampling and benthic observations will be done in areas which showed reason for concern.

b) ESTUARINE ASSESSMENT

In 1989 an extremely limited amount of water sampling was conducted in the estuary (The Enclosure to Portage Island). The limited nature of the sampling does not permit proper interpretation therefore the results are not discussed.

c) SOURCES OF POLLUTION

In 1989 and early 1990 an inventory of possible point sources of pollution was compiled from government records and committee recommendations and is listed in Appendix 3. All points listed may not have actual discharges to the river but are listed for initial review.

WORK PLAN FOR 1990

a) FRESHWATER

The work scheduled for 1990 will be a partial continuation of 1989 for historical data collection and confirmation but an important part will be to revisit areas which showed significant impacts or indicated possible problems as identified by the benthic invertebrates and water quality.

b) ESTUARINE

The majority of effort in 1990 will be concentrated in the estuary or salt water part of the river. The impact of pollutants may be noticed in the water, the sediments, and the aquatic organisms but it is the sediments and the living things which will concentrate any pollutants in the water. For this reason most of the important and expensive chemical testing to be done will be on samples of sediment and aquatic life.

i)Sediment Testing

The committee expects to get a large amount of sediment test data from Public Works Canada for the Morrissey Bridge to Portage Island section in mid 1990 and as a result will limit its sediment sample collection. The area off Point aux Carr will be looked at since this is where sediment from upriver and offshore tends to settle. Testing will be done for heavy metals such as zinc, copper, cadmium, lead, mercury, and arsenic plus organic chemicals such as PAH, PCB, PCP, and other selected chlorinated compounds.

ii)Aquatic Organism (Biota) Testing

The biota of interest are a combination of the ones which have definite value to the public for recreation or income and those which would be expected to show the effects of pollutants first. The following is a list of the species which will be of interest for testing for a variety of heavy metals and organic chemicals:

Salmon	Lobster	Mussels
Shad	Gaspereaux	Clams
Striped Bass	Eels	Quahogs
Oysters		

Depending on the kind of biota, different chemicals will be tested. In some cases the liver will also be tested since many organic chemicals such as PCB's, PAH's, and pesticides have a tendency to concentrate here rather than in the flesh.

These samples will be collected from the Fisheries and Oceans Canada fish trap at Millbank and where possible from commercial catches.

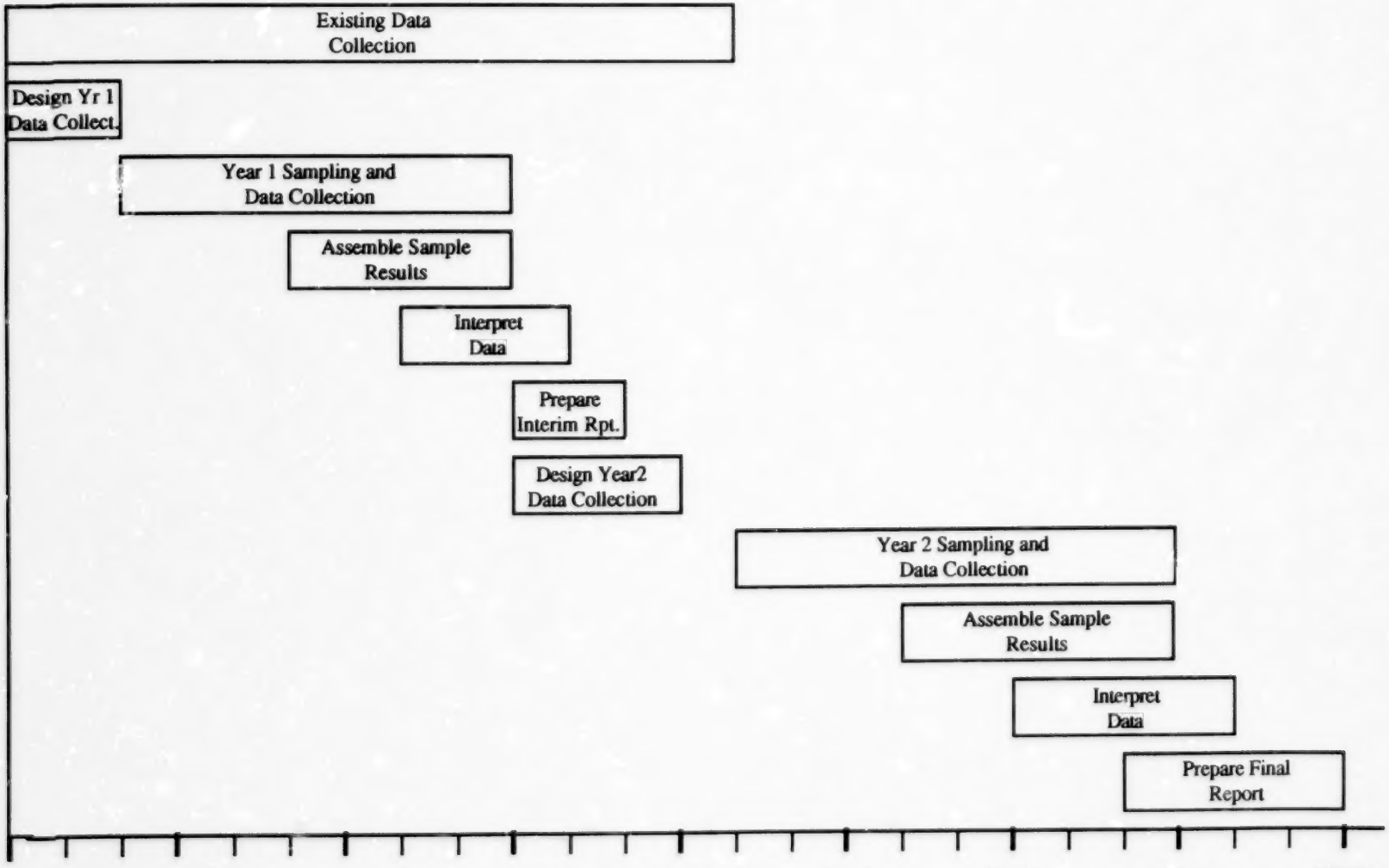
c) SOURCES OF POLLUTION

The potential which the sources listed in Appendix 3 may have for pollution will be reviewed in 1990 and many will be inspected and sampled for pollutants specific to the particular industry or source through a program coordinated with the NB Department of the Environment.

The above potential sources are point sources since they discharge to the river system at a specific point. The following potential sources can also have an impact but are referred to as non-point sources because the point of discharge is so spread out are:

1. Dredging activity and dredge spoils disposal
2. Acid precipitation including snow melt
3. Forest clear cutting
4. Forest pesticide spraying

Miramichi River Assessment Two Year Schedule



June 1, 1990

5.0 PRESENTATION OF INFORMATION AND DATA

INTRODUCTION

As stated earlier, the majority of field work in 1989 was on the freshwater sections of the river with data collection extending down to the junction of the Northwest and Southwest branches. Limited sampling was done in the sections from here to the barrier islands but not in sufficient amount to report.

A series of stations was established throughout the watershed, which was set to give information at crucial points in the system. Twenty-six in all; nine received monthly sampling until April 1990 while the remaining were monitored for water quality June through September 1989. A variety of chemical, solids, metals and nutrient parameters were analysed monthly for each station. In addition dissolved oxygen and temperature were checked at many stations periodically. More important, a study to evaluate benthic invertebrate population at ten of these stations was undertaken to supplement water quality data. These benthic organisms are good (especially long-term) bio-indicators of either the stability or possible stress seen in aquatic environments.

These stations (water and benthic) were selected to best represent the Miramichi system both as background stations and as points reflecting the assimilative capacity of the river in areas where alleged or actual impact exists. The location of the monitoring stations is shown on Figure 1 at the end of this section.

A variety of natural conditions influence the water quality at any location and must be considered in any interpretation: groundwater sources, substrate geology, topography, drainage, precipitation, flow and soil chemistry. These factors are important and additional information on some of these is being sought to better assess their influence on the water quality of each station.

The interpretation of any data, is substantiated or deemed more reliable, the more information you have. Thus conclusions, trends or questions arising from those stations monitored year round are more founded than those geared toward four months of sample collecting. It is all relevant and important, however, in assessing the status of the Miramichi, and just as important in directing future study where it is needed.

The following is a brief summary of the water quality and benthic results for each station and what they indicate to be the aquatic environmental conditions of these points.

The water quality data collected was compared against standards set for protection of aquatic life by the Canadian Conference of Ministers of the Environment. The more common ones referred to below are dissolved oxygen, pH, metals(zinc, copper, lead, etc.), and coliform bacteria. Dissolved oxygen levels required depend on the sensitivity of the species with salmon and trout needing higher levels than coarse bottom fish. The more sensitive species need about 6.0 ppm or better. The pH range acceptable is 6.5 to 9.0 with tolerence on either end of about 0.5. Acceptable metal levels are different for each metal and also depend on the hardness of the water to a smaller extent. Coliform bacteria are not of concern to fish or shellfish except to the extent that they may limit human consumption especially in shellfish. The limit for swimming is set at 200 fecael coliforms per 100 millilitres of water sample for disease transmission concerns. Nutrient limits are set for phosphorus and nitrogen compounds to keep algae growth from becoming too heavy in the water which can in turn use up the available oxygen and reduce clarity.

STATIONS 1-9 and # 19 received benthic monitoring June-September 1989 and monthly water sampling June 89-April 90 (except # 19 only June-September 89)

MIR. 1 JUNIPER STATION

Benthic studies indicate a stable healthy environment. Population and diversity are good. Any decline in these is probably due to limiting factors such as flow, temp. etc. River character changes to slower moving stream in summer.

Water is soft and well buffered against acidification. Average pH 6.9. Naturally dark yet clear. Some natural organic loading, doubtful if any significant domestic input. Metals and coliform good. Dissolved oxygen and water quality are good.

MIR. 2 BLOOMFIELD RIDGE

Benthic studies show healthy populations with wide diversity. Thriving stable environment. Fast water year round.
Very soft water. Still buffered against acidification but slightly more sensitive than Juniper. Less color (less natural organic loading). Dissolved oxygen very good (as was Juniper) 9.6 to 10.5ppm mid summer. pH 6.8 approx. Metals and coliform good. Overall good water quality.

MIR. 3 BOIESTOWN

Benthic populations showed very wide variety - good indicator of a healthy community. A very dynamic community - stable and adaptable. Some diversity declined in peak summer - water levels dropped and temperature elevated. Very soft water. Slightly more sensitive to acidification. Lower buffering capacity. More colored than upstream sites - possibly more organic loading - mostly natural. Dissolved oxygen very good. pH average 6.6. Coliform overall good - elevated levels in August, near limit, may indicate some localized sewage discharge. Metals good.

MIR. 4 DOAKTOWN

Benthic studies showed a progressive decline in overall stability as the summer progressed. Dropping water levels, temperature increase, sedimentation or an unnatural factor saw low oxygen tolerant species steadily increase. Some species did rebound in September.

Water still quite soft. Well buffered against acidification. Color similar to Boiestown. pH approx. 6.75. Sporadic elevation of solids and nutrient parameters were observed. Coliform levels were generally good.

MIR. 5 BLACKVILLE

Benthic populations saw a notable progressive decline in density and numbers all season. Low oxygen tolerant species appeared and subsequently predominated later. The total extent of the decline did not match identified stressed areas - but the rate of the decline exceeded this. Physical, chemical or unnatural conditions - or any combination may contribute to this situation.

Very soft water. Well buffered against acidification. Aluminum levels elevated above natural background levels(1300 to 1400 ug/l). Investigation into this and toxicity is continuing. Dissolved oxygen good. pH approx. 6.7. Slight organic loading. Coliform generally good (close to limit in July and Aug.)

Although both Doaktown and Blackville are not suspected to be high impact locales. - abnormal invertebrate results - despite generally good water quality warrant future consideration.

MIR. 6 NEWCASTLE (ENCLOSURE PARK AT RAILWAY) S.W. MIRAMICHI

Benthic results were not good. Extremely low numbers and diversity were found. Second lowest level of diversity recorded. In peak summer, only very tolerant species dominated in low numbers. Poor aquatic ecosystem.

Tidal action in the area masks interpretation of water quality parameters in some surveys. Future surveys should concentrate on synchronizing tide peaks and lows with desired sampling. Both extremes should be looked at. Many parameters cannot thus be attributed to be elevated objectively by either tide or impact. What is seen definitely, is a very poor benthic invertebrate state probably due to a very unstable and possibly contaminated sediment continually deposited with tidal movement. The quality of the water transporting this suspended matter may be less than desirable but definitely more work is needed to substantiate this. Coliform levels, with some inconsistencies were generally within limits. There was evidence of some nutrient loading and there exists the possibility of various contaminants moving upstream with the tide.

MIR. 7 NORTHWEST MIRAMICHI AT HIGHWAY 8 BRIDGE

Benthic results showed an extremely stressed system. Only very tolerant species managed to survive at all till the summer - then all disappeared. Lack of any species adaptable to either salt or fresh water indicates severe limiting factors present. This is the main channel of the incoming tide. Any impact originating from the Newcastle/Chatham area would likely find its way here. Future tidal sampling is needed as are more information on tide mechanics, sediment and point source contribution. Sediment deposition by the transient water body (and the quality of the sediment, suspended matter and the water) definitely impact the invertebrate populations. Water quality interpretation is influenced by estuarine conditions. Some parameters, although affected by salt water, exhibit levels which are of concern. Both metals and organics fall into this category. Coliform levels showed 60% of total readings exceeded the acceptable limits.

The status of both stations 6 and 7 warrant future coordinated surveys to further assess these impacted areas.

MIR. 8 N.W. MIRAMICHI AT WAYERTON

Benthic results showed a very diverse community with stable populations. Overall variety, numbers and adaptation indicate a healthy environment. The community is generally distinct to a rapid water situation. (some diversity decline noted in peak months - probably associated with lower water levels).

Water showed an elevated hardness (moderate) over the main southwest possibibly attributable to natural conditions. Buffering capacity to acidification is good. A few sporadic elevations in a few parameters may be attributed to a variety of factors - lab error, field sampling contamination or possibly may exist due to a fluctuating impact. This issue is being investigated. Elevated level of zinc in the winter months is noted and has been brought to the attention of NB Dept of the Environment. Coliform results were good except for July. This could be attributed to low water levels and some localized domestic discharge in the vicinity. The status of this station is good but attention should be focused on the source and impact of the elevated zinc levels.

MIR. 9 LITTLE S.W. MIRAMICHI AT LYTTLETON

Benthic studies showed a very diverse site. Some species found here are indicative of only very good waters. A stable community exists which adapted to changing water conditions as the season progressed.

Very soft water. High background aluminum levels. Moderately buffered against acidification. pH 6.7. Normal expected nutrient loading. Coliform good. Very good water quality.

MIR. 19 NAPPAN RIVER HIGHWAY 11 BRIDGE

This was an invertebrate station, but monitored for water quality only for the summer months.

Benthic studies showed a progressive diversity decline with poor species representation. Low Oxygen

tolerant species dominated. A staggering or fluctuation in numbers and diversity of different types of insects associated with different conditions may indicate a changing environment. This may be due to natural conditions being unstable or possible abnormal limiting factors coming and going.

Water appears to be very soft and heavily coloured. Organic loading is high and probably not all of natural origin. Coliform results for June and July were slightly over the acceptable limits. August and September were satisfactory.

The following Stations were monitored for water quality only June-September 1989.

MIR. 10 SOUTH BR. OF SOUTHWEST AT JUNIPER BRIDGE

The water at this station is soft and well buffered against acidification. Nutrient levels fall into the range of natural loading. pH is approximately 6.8. Coliform results were good. Water quality is quite good overall.

MIR. 11 SOUTHWEST AT DEERSDALE

Water at this station is quite soft. It is moderately buffered against acidification, a slight rise over Juniper. Nutrient and organic levels slightly elevated in the low flow peak months. Less dilution and some possible upstream release (ie. Juniper Village), may contribute to this. Coliform levels maintained within acceptable limits. Overall, the water quality is good.

MIR. 12 SOUTHWEST AT LUDLOW BRIDGE

The water here is soft and well buffered against acidification. Water quality is quite good with a few nutrient levels indicating slight elevations due possibly to marginal impact upstream. Coliform results are good.

MIR. 13 SOUTHWEST AT NELSON'S HOLLOW

Water is soft and well buffered against acidification. pH is approximately 7.0. No nutrient abnormalities - coliform was good. Very good water quality.

MIR. 14 SOUTHWEST AT UPPER BLACKVILLE BRIDGE

Very soft water, well buffered against acidification. Background aluminium levels elevated between Juniper and Bloomfield Ridge are lower here. (began to drop at Boiestown). No evidence of any nutrient loading. Coliform levels are good.

MIR. 15 CAINS RIVER NEAR MOUTH OF OTTER BROOK

Water is generally soft and well buffered against acidification. The color is darker than the main river probably due to natural organics. pH is near 7.0. Overall the water quality is good, as are the coliform levels, except for one reading in June. (due to the location of the station, sample contamination would be the likely explanation for the high level in June).

MIR. 16 BARTHOLEMEW RIVER AT BLACKVILLE

The water of this river is soft and well buffered against acidification. pH is approximately 7.0. Slight

nutrient elevations are seen in a few months. August showed coliform levels slightly above or at acceptable limits. Possible stress from upstream sewage sources contributes to these levels. Other parameters appeared good.

MIR. 17 SOUTHWEST AT QUARRYVILLE BRIDGE

Soft water well buffered against acidification. Water slightly more colored than upstream stations. Various tributaries have entered river by this point. July showed readings of nutrient and organics elevated with corresponding coliforms levels above acceptable limits. Definite indication of some stress, upstream or in the immediate station locale. Other parameters were good.

MIR. 18 BARNABY RIVER - HIGHWAY 118

Soft water well buffered against acidification. Highly colored-spordic elevations of few different parameters, although none of serious concern. A more consistent elevation in organics, and coliform level in July above the limit, indicates the possibility of some upstream impact. Other parameters were generally good.

MIR. 20 BLACK RIVER AT HIGHWAY 11 BRIDGE

Very soft water well buffered against acidification. Highly colored. Consistently high dissolved organic carbon readings point to probable abnormal nutrient loading. TKN levels substantiate this in July and August as do phosphorous levels throughout. Coliform levels in July over limit.

MIR. 21 BAIE DU VIN RIVER AT HIGHWAY 11

Soft water, well buffered against acidification and highly colored. Organic and nutrient levels indicate some abnormal loading. Coliform levels were below limits. pH, approximately 7.0. Other parameters generally good.

MIR. 22 SEVOGLE RIVER NEAR MOUTH

Very soft water moderately buffered against acidification. pH approximately 6.8. Unnatural and unexpected nutrient elevation in July. Probably due to some isolated discharge (source). Coliform levels good as was overall water quality.

MIR. 23 RENOUS RIVER NEAR MOUTH

Soft water well buffered against acidification. pH, near 7.0. Water quality very good with no abnormal loading indicated. Coliform results were good.

MIR. 24 DUNGARVAN RIVER NEAR MOUTH

Soft water well buffered against acidification. pH approximately 7.0. Coliform good. Water quality generally very good.

MIR. 25 SOUTHWEST BELOW OLD BURNTHILL MINE SITE

Very soft water well buffered against acidification. pH approximately 7.0. Coliform very good. No

evidence of abnormal trends. Water quality very good.

MIR. 26 TAXIS RIVER NEAR MOUTH

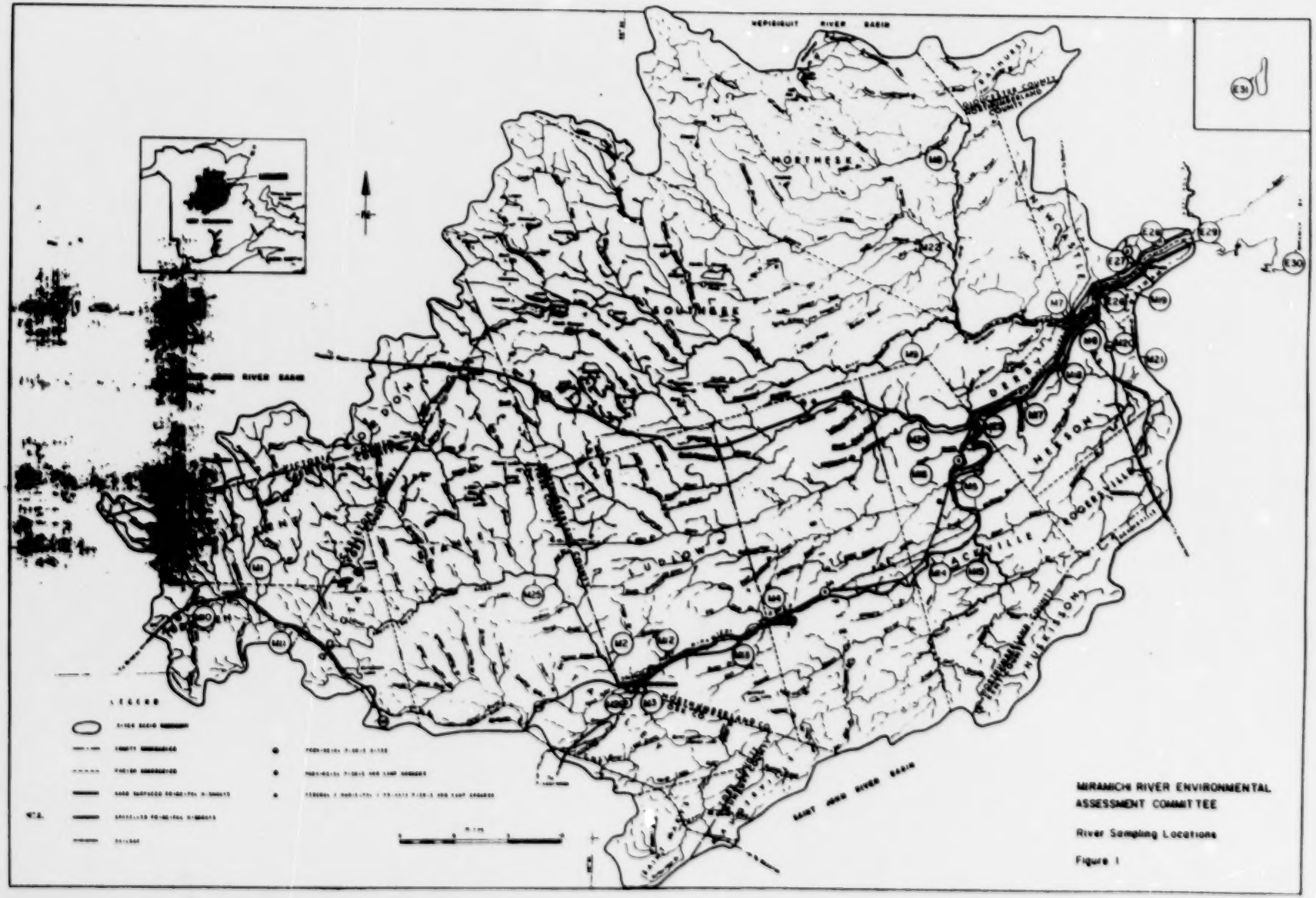
Soft water well buffered against acidification. pH near 7.0. Some nutrient levels slightly elevated July and August. Coliform levels very high in June and August and high in September. Problem has been identified and action to remedy situation is being taken by NB Dept of Health and Community Services. Water quality is generally good except for localized sewage situation.

CONCLUSIONS

The comments on these twenty-six stations provide a general insight as to their individual environmental status. What is desired, is to link these stations together to give an overall picture of the present quality of the Miramichi system. To do this, a variety of things must be done. These individual stations showing signs of stress or impact must be investigated in more depth to identify problems if they exist and the scope of their effect on the river. Those points showing good water quality may require additional study to substantiate either the background state or assimilative capacity of the river. The remaining field work to be done for this project is very important in correctly interpreting the status of the Miramichi River.

The present data shows the overall quality of the River to be good. Considering the system from Juniper to Chatham (and all the tributaries), it is only toward the more heavily populated, industrialized mouth of the river (MIR 6 and MIR 7) that serious concerns arise. There are points, however, farther upstream that indicate possible stress and warrant future investigation also. We are at a point in our study, where we have identified areas of concern; and need more work to isolate specific problems and assess their impact on the river. To supplement the baseline (and receiving water) studies to this end, a point source study dealing with many facets of industrial, domestic sewage impacts on the river has been devised. The results of this study will assist in identifying problems and interpreting current data along with giving some direction for emphasis on future action. Historical data on both point source characterization and water quality stations, will aid in evaluating the level of any impact and trends of change in the quality of the river.

The remainder of the study, while maintaining monitoring continuity through the system, must priorize and put emphasis of both benthic and water quality monitoring on those probable stressed areas. Additional and more intensive field studies are needed especially in the highly industrialized areas to assess their impact and inevitably lead to remedial action, if needed, in the future.


MIRAMICHI RIVER ENVIRONMENTAL ASSESSMENT COMMITTEE
River Sampling Locations
Figure 1

6.0 EXPERT PRESENTATIONS TO THE COMMITTEE

As part of the Committee's monthly meeting format they frequently invite speakers on topics which they feel are important to their knowledge of the river and the influences on it.

Noted below are the speakers and topics covered since the Committee started in May 1989.

July 18/89 Trends, Periodicities and Changes to River Flow in the Miramichi Basin
by James Anderson, NB Dept of Environment

Aug 22/89 Pesticide Use in the Miramichi Basin
by Ken Browne NB Dept of Environment
Nelson Carter NB Dept of Natural Resources
Tom Pollock Environment Canada

November 7/89 Acidity and Chemical Composition of Precipitation
by Jane Tims, NB Dept of Environment

December 5/89 Dredging in the Miramichi River
by Alan McIvar Environment Canada
Ross Woodworth Public Works Canada

January 9/90 Fisheries of the Miramichi River
by Bob Randall, Fisheries and Oceans Canada

March 6/90 Catamaran Brook Habitat Research Project
by Dr. Rick Cunjak, Fisheries and Oceans Canada

Brief summaries of most the above talks were provided by the speakers. If readers are interested, individual copies can be obtained by contacting the Project Coordinator.

In addition to these presentations to the Committee, a meeting was held on November 23,1989 at Loggieville to which local commercial fishermen were invited. Mr. Sandy Campbell of the Fisheries and Oceans Canada, Scotia-Fundy Region spoke on fish diseases and shipping of samples of abnormal fish to DFO for assessment. An extremely important part of the evening were the comments of fishermen on their observations over the years of fish which they had landed and local impacts on their business.

PART II

7.0 THE RIVER ENVIRONMENT - AN OVERVIEW

Prior to assessing the quality of the waters of the Miramichi River system, it is important to understand the factors which influence water quality in a pristine environment. Water quality and physical characteristics combine to determine the numbers and types of life forms that may inhabit the river.

The quality of water in an undisturbed river environment is influenced first by that water's source. Rivers rely on surface waters in the form of precipitation that washes the land on its way to the river and groundwater contributions in the form of springs and seeps.

Precipitation is naturally acid due to natural atmospheric chemistry and low in nutrient content. Water that has flowed over land before reaching the river will undergo a change in chemistry. The chemistry of the water is changed by the contact with the soils and substances it encounters on its way to the river. As the water washes the land it picks up minerals, nutrients and colour from the soil, exposed bedrock, and decaying organic matter on the forest floor. Acid rain will increase the chemicals picked up in this land washing process. Water not reaching the river is returned to the atmosphere or seeps downward to become groundwater.

Groundwater quality is influenced by its longer contact with the bedrock chemistry which may vary markedly throughout the river basin. Groundwaters, returned to the surface though springs and seeps, are cooler and generally contain higher levels of dissolved chemicals than surface waters.

The mixing of surface and groundwaters in a river gives each river its distinctive quality. As seasons change, precipitation amounts vary. During periods when less precipitation is available to augment flows, river flows are made up of a higher percentage of groundwater. The resulting change in quality occurs gently and is a regular annual pattern.

The topography and geology of a river basin determines the river's slope, velocity and the nature of its bottom over its length. Rivers with rapid vertical drop scour their bottoms leaving only exposed bedrock and boulders. Scoured materials are carried downstream until stream velocities allow for their settling. Finer materials require even lower stream velocities to settle.

The volume of water flowing in a river is determined by the size of the watershed, precipitation amounts and groundwater contributions, slope and runoff rates. Land cover types and differing soil conditions heavily influence runoff rates.

There is no singular water quality typical of an unaltered environment but rather a variety of qualities which reflect the variety of combinations of the factors above. The dark colored waters of streams draining low lying lands offer a stark contrast to the sparkling clear waters of a river system rising from spring flows in rocky terrain. However, each may be representative of a pristine environment.

Over time each section of a river, influenced by the above factors, has established a stable water quality and bottom type. Once a water quality and bottom type has been established in a river section, life forms suited to the environmental conditions will form a stable community. The community stability is dependent upon the stability of the environment and the balance between the species in the food chain in this river section. Water quality, the physical environment and living organisms are inseparably interrelated in an ecosystem. Once established, the diverse population of life forms is self sustaining. Each life form has a range of tolerance for a variety of factors like temperature, dissolved oxygen, nutrient and metals concentrations.

Each river system has the ability to accept some inputs without disrupting the naturally established ecosystem. This ability to absorb incoming stresses, whether man made or of natural origin, is referred to as assimilative capacity. Just as different river sections have differing environments and biota, they may also have differing assimilative capacities.

8.0 THE MIRAMICHI RIVER SYSTEM

The Miramichi River basin covers an area of approximately 14,000 km^2, is roughly elliptical in shape, and extends 190 km east to west and 95 km north to south. The estuarine or saltwater section starts at the barrier islands of Fox and Portage where it is about 22 km wide and extends inland some 80 km to the tidal limit. In the Northwest this is to about the Red Bank bridge while in the Southwest to about Quarryville. The estuarine section covers about 300 km^2. The normal tidal variation is about 1 metre. In the Miramichi the salt and fresh water mix quite rapidly whereas in some rivers the fresh water has a tendency to move out on top of the salt water. The watershed reaches a maximum elevation of over 750 m at Bald Mountain in the north, while the remainder of the watershed ranges from 200 m to 600 m above sea level. Ice cover is usual from December to April. The land slope (topography) of the river basin is generally regular with many parallel tributaries draining from the western watershed. There are very few large lakes, but numerous small pools in the upper reaches.

In general, the headwaters of the branches of the Miramichi River are underlain by the oldest rock. The headwaters of Southwest and the Little Southwest are underlain by granitic rock which causes a number of rapids in the upper reaches. The Northwests' headwaters are underlain by less resistant rock and includes ore bearing deposits like zinc, copper, lead, silver, and gold. Most of the drainage basin is covered by silts, sands and gravel deposited by glacial action. The estuary sediments are composed mostly of fine grained silts and muds originating mostly from the river. The deposition rate is 1 to 3 mm/year.

The basin is part of the Acadian forest region, is predominantly wooded, and supports a mixed forest of spruce, fir, hemlock, pine, maple and birch. The entire region has been extensively cut-over during the last 200 years. In addition to forest harvesting, fires also have played a significant role in determining the state of today's forest. In October of 1825, the Great Miramichi Fire destroyed over 15,000 km^2 of forest and most of the present day towns of Newcastle and Douglastown.

The land use or type in the watershed is divided roughly into the following categories:

Forest Land (Crown and private)	93.5	%	Farm Land	2	%
			Municipal	2	%
Industrial	0.5	%	Mining	1	%

River flow varies considerably throughout the year, however, the mean annual discharge is estimated to be 300 cubic meters per second (or roughly 5.7 billion gallons per day). The river flow generally peaks in early spring whereas the lowest flows occur during late summer and again in mid-winter under the cover of ice. The estuarine part of the river is generally shallow with depths ranging from 4 to 8 metres except on river bends where currents have scoured to 14 metres. Flow dynamics in the river are such that sediment carried downriver and any small amounts from the outer bay tend to accumulate in a low flow "quiet" zone off Point aux Carr called the Grand Dune Flats.

The Miramichi is home to a wide variety of aquatic life with the estuary supporting the greatest diversity and most of the commercially harvested species. The freshwater sections support the extremely important recreational species such as salmon and brook trout as well as providing the spawning and early growth areas for many species. The fish include salmon, trout, smelt, shad, gaspereaux, herring, mackerel, flounder, striped bass, tomcod, and eels. Other species include lobster, oysters, crab, clams, mussels, and quahogs. Many other organisms exist in the system and although they may not be important for recreational or commercial reasons they have a definite place in the environment, many as food for the species we consider important.

In addition to the natural inhabitants of the river there are many human groups using the river for their own purposes. These include recreation as fishing, boating, and swimming; commercial fish harvesting of wild and cultured species; water withdrawl for industrial/domestic use; commercial ship traffic; and wastewater discharge both industrial and municipal. All these user groups have an impact on the natural inhabitants and each other.

9.0 POLLUTANTS AND SOURCES

Pollutants may be classified according to their nature as:

* Physical pollutants such as suspended solids or silt

* Chemical pollutants such as
  Inorganics - heavy metals, phosphorus
  Organics - PCB's, PAH's, petroleum, pesticides

* Biological pollutants - bacteria, viruses

According to their fate in the environment pollutants can be broken down into groups:

* Rapidly biodegradable

* Moderately biodegradable

* Persistent

Rapidly biodegradable pollutants are decomposed in a matter of days but consume oxygen from the water in the process. Much of municipal sewage and pulp mill effluents are in this group.

Moderately biodegradable pollutants decompose fully or partially in a matter of weeks or months consuming oxygen more slowly but are available to impact the ecosystem for longer. Examples are hydrocarbon fuels and some detergents.

Persistent pollutants are very slowly or not broken down by bacteria in the environment. Examples are heavy metals and PCB's. This group has the potential to build up in specific parts of aquatic organisms such as the liver or fatty tissue. The build up may or may not harm the organism but as these organisms are consumed by species higher in the food chain the pollutant bioaccumulates until it reaches a species it can affect such as birds, animals, or humans.

Any of the above groups can have acutely toxic (lethal) effects on organisms in that they can be in high enough concentration or use up enough oxygen that they cause immediate death (in days) of the species. The persistent pollutants can cause this immediate effect in high concentrations but can also have sub-lethal or chronic effects at low concentrations. These sub-lethal effects could be loss of reproductive capacity, loss of motor control, or poor weight gain among many.

Pollutants can also be classed by how they enter the river system. They may be discharged from a "point source" such as a sewer pipe or from a "non-point" source such as land runoff over a very wide area and contain pesticide residues or acid rain chemicals. In the case of a point source discharge into a body of water, the source is surrounded by an area where a dilution of the discharge takes place. This area is the mixing zone where the effect of the effluent is clearly visible by eye or chemical testing. If point source discharges are to be allowed then some impacted mixing zone must also be accepted, however the size of the zone relative to the receiving water is the critical factor in what the environmental impact will be.

In assessing the state of a river, testing can be done for pollutants on water, bottom sediments, and aquatic organisms which would be expected based on the activities in the watershed. The impacts will be most easily seen in reverse order with the organisms showing the most since they live in the water, on the sediments, and eat food from the river environment. Based on experience elsewhere different chemicals will build up in different organisms and in different parts of their bodies. Fish flesh with low fat content will be low in PCB's while the fatty liver of the same fish may contain high levels. Similarly fish which migrate and spend little time in the area like salmon would be less likely to accumulate local pollutants than eels which live their whole life in the same general area.

Pollutants and sources specific to the Miramichi River basin have been reviewed by the Committee. The chemicals noted previously were selected because of their use and existence in the area. Other chemicals may be identified in general scans of selected organism samples to be tested by the Committee.

The Committee has also made a listing of the potential sources of pollutants and has a program for assessing these in 1990. A full listing of these sources is in Appendix 3 of this report.

PART III

APPENDIX 1 - MEMBERSHIP OF THE MREAC

The members of the Committee are as follows, truly representing a dedicated and diverse interest in environmental aspects of the Miramichi:

Vernon Goodfellow (Chairman)	Northumberland Salmon Protection Ass.
Vince McCarthy(Vice-Chairman)	Mayor, Nelson-Miramichi
Harold Parlee (Treasurer)	Nordin
Tom Greathouse (Secretary)	Citizen, Newcastle
Joyce Allen	Citizen, Newcastle
Michael Augustine	Red Bank Indian Band
Ben Baldwin	Miramichi Environmental Society
Rupert Bernard	Mayor, Town of Chatham
Neil Brodie	NB Environment
John Brown	Citizen, Chatham
Jennie Bryenton	Greater Miramichi Chamber of Commerce
Bernie Dube	NB Natural Resources & Energy
Edmond Drysdale	Maritime Fishermen's Union
Claude Ferron	Heath Steel Mines
Ted Frank	Miramichi Environmental Protection Ass.
John Legault	Dept. of Fisheries & Oceans-Gulf Region
George Lindsay	Environment Canada
John MacDougall	Miramichi Pulp & Paper Inc
Timothy McCarthy	President, NB Labour Council
Peter Murphy	Mayor, Newcastle
Joe O'Neill	Miramichi Pulp and Paper Inc
Gilbert Savoie	Northumberland Woodlot Association
Michael Sprague	NB Environment
Harry Williston	Miramichi Commercial Fishermen
Jerry Wilson, MD	Nordin
Vlado Zitko	Dept. of Fisheries and Oceans-St. Andrews

Alternates:

Zoel Breau	Maritime Fishermen's Union
Ernest Ferguson	Dept. of Fisheries & Oceans
David MacLeod	Miramichi Environmental Protection Ass.
Roy Parker	Environment Canada

Project Coordinator:

Jack Hunter	Sunny Corner

Technical Advisory Group:

Neil Brodie	NB Environment
John Legault	Dept. of Fisheries and Oceans
George Lindsay	Environment Canada
Michael Sprague	NB Environment
Vlado Zitko	Dept. of Fisheries and Oceans

APPENDIX 2 - GOVERNMENT REGULATORY LEGISLATION AND PROCESSES

The summaries below are very limited. If more detail or explanation is required the reader should contact the government department administering the act or regulation.

1) Fisheries Act (Administered by Fisheries and Oceans Canada and Environment Canada)

Habitat Protection Provisions (Fisheries and Oceans Canada)

In addition to the regulations for particular fisheries, the Federal Fisheries Act also has specific sections for the protection of fish habitats. Some of the habitat concerns covered by the "Act" include: The Department of Fisheries and Oceans requires details of all work proposed in or near the water, fishways are required around obstacles where there is a fishery resource, where work does occur in the water the flow must be sufficient to allow fish passage, one third of the river must remain open at all times, any alteration of a fishway must be approved by the Department, explosives use in fish bearing waters must be approved by the Department, as must fish guards and screens for all water intakes.

Pollution Control Provisions (Environment Canada)

The pollution control provisions prohibit the deposit of deleterious or harmful substances, except where authorized under the Fisheries Act or other federal statutes. They also contain regulatory authority for the designation of substances as deleterious and the setting of limits for their deposit. They allow creation of a regulation for the issuance of site-specification authorizations, that is, authorizations which set limits for deposit of a deleterious substance or substances that is specific to a particular site. Under these sections, the Minister of Fisheries is powered to require an individual, company or government department or agency to submit plans, specifications, and other information related to an activity that involves deposit of deleterious substances in waters frequented by fish. Then, based on this information, the Minister may make orders dealing with the conduct of the activity that gives rise to deposit of deleterious substances in waters frequented by fish. Then, based on this information, the Minister may make orders dealing with the conduct of the activity that gives rise to deposit of deleterious substances in waters frequented by fish. The provisions also require reporting of abnormal deposits of a deleterious substance or substances which occur in contravention of the general prohibition, regulations or site-specific authorizations.

In addition, the sections contain the authority to appoint inspectors and analysts and also describe inspectors powers, including entry, search and the authority to direct preventive, corrective or cleanup measures. Penalties for offenses are also set out, as well as a description of court orders that may be imposed following a violator's conviction for an offence under the pollution control provisions. Further, the provisions allow the Crown to recover, through civil suit, costs of preventive, corrective or cleanup measures.

The Fisheries Act, including the sections described above, applies to "persons" who may be individuals or companies. It also applies to Her Majesty in right of Canada or a province - in other words, to both federal and provincial government departments and agencies and their employees.

Exceptions to the general prohibition against deposits of deleterious substances

While the Fisheries Act contains a general prohibition against any deposit of a deleterious or harmful substance into waters frequented by fish, the Act allows the creation of exemptions to the prohibition. These exceptions are made by regulation or under an authorization granted for specific site.

2) Canadian Environmental Protection Act (Administered by Environment Canada)

The full title of the legislation is "An Act respecting the protection of the environment and of human life and health", which clearly defines the purpose of the statute. Also, the Declaration of the Canadian Environmental Protection Act states that "the protection of the environment is essential to the well-being of Canada",

underscoring the importance placed by the Government of Canada on the concept of environmental protection.

The Canadian Environmental Protection Act has the following elements:

* authority to control the introduction into Canadian commerce of substances that are new to Canada;

* authority to obtain information on and to require testing of both new substances and substances already existing in Canadian commerce;

* provisions to control all aspects of the life cycle of toxic substances from their development, manufacture of importation, transport, distribution, storage and use, their release into the environment as emissions at various phases of their life cycle, and their ultimate disposal as waste;

* authority to regulate fuels and components or fuels;

* authority to regulate emissions and effluents as well as waste handling and disposal practices of federal departments, boards, agencies and Crown corporations.

* provisions to regulate federal works, undertakings and federal lands and waters, explore existing legislations administered by the responsible federal department or agency does not provide for the making of regulations to protect the environment;

* provisions to create guidelines and codes for environmentally sound practices as well as objective setting desirable levels of environmental quality;

* provisions to control sources of air pollution in Canada where a violation of an international agreement would otherwise result, or where the air pollution affects another country and reciprocal legislation to control the sources of the pollution exists;

* provisions to control nutrients, such as phosphates, in water conditioners or cleaning products, including detergents, which can interfere with the use of waters by humans, animals, fish or plants;

* provisions to issue permits to control dumping at sea from ships, barges, aircraft and man-made structures (excluding normal discharges from off-shore facilities involved in exploration for, exploitation and processing of seabed mineral resources); and

* authority to sign agreements with provincial governments regarding administration of the Act.

Protection of the environment is a responsibility shared by all levels of government as well as by industry, organized labour and individuals. For this reason, the Canadian Environmental Protection Act gives the Minister of the Environment the authority to conclude, with the approval of the Governor in Council agreements with provincial governments concerning the administration of the Act.

3) Navigable Waters Protection Act (Administered by Transport Canada,Coast Guard)

The Act is designed to protect the public right to navigation by prohibiting the building or placement of any work in navigable water without the approval of the Minister of Transport. "Navigable waters" includes any body of water capable, in its natural state, of being navigated by floating vessels of any description for the purpose of transportation, recreation or commerce; it also includes a canal and any other body of water created or altered for public use, as a result of the construction of any work, as well as any waterway where the public right of navigation exists by dedication of the waterway for public purposes, or by the public having acquired the right to navigate through long use.

The following are examples of works that would require approval:

a) Any bridge, causeway, trestle, culvert, dam, boom, wharf, dock, jetty, breakwater, retaining wall, gabion wall, barge platform, slipway, pier, ferry terminal facility, tunnel, floating raft, ski jump platform, marina facility, weir, log boom tie-ups, piles, dolphins;

b) Aquaculture/mariculture facilities(i.e. fish cages, longlines, bottom culture)

c) excavation, dumping or dredging of material including dumping of any material likely to contain sediment that affects the depth of water

d) overhead, submarine, telegraph or power cable or wire, pipelines for gas oil or solids, water pipes, water intake and outfall structures, sewer pipes or outlets

e) scientific towers or artificial islands constructed for the development of natural resources

Information on and application for projects can be made through Canadian Coast Guard District or Regional Offices.

4) Crown Lands and Forests Act (Administered by NB Dept of Natural Resources and Energy)

The Department advises that their act is too complex to be summarized into one paragraph so interested readers are advised to direct specific inquiries to NB Dept of Natural Resources and Energy.

5) Clean Environment Act (Administered by NB Dept of the Environment)

a) Environmental Impact Assessment Regulation

Under this regulation any undertaking or project which is covered by the list of undertakings in the regulation must submit a project registration prior to any work starting. Based on the information gained through the registration process the Minister will determine if a full Environmental Impact Assessment (EIA) is required. If not the Minister may screen the project out of the process with or without conditions attached to how the project is done. This does not exempt the project from any other environmental regulation requirements. If an EIA is required, guidelines are developed for the EIA study with public input and the person or company proposing the project is required to carry out the study. When the Minister is satisfied the study meets the guidelines developed, it is made available to the public prior to public meetings being held in the area. After this the Minister of the Environment makes a recommendation to the Provincial Cabinet and the project is approved or denied. The project may be approved with any number of conditions attached. If approved the project must comply with any other environmental regulation requirements.

b) Water Quality Regulation

Under this regulation persons or companies require a Certificate of Approval to construct and/or operate a source which discharges contaminants to the environment. This is generally directed at dischargers of industrial and domestic sewage wastes and specifies how the wastes must be treated before being released. Certificates are given for a maximum of five years and may be revoked by the Minister at any time. Application must be made for an Approval which show what amount and type of pollutants will be produced and what treatment design will be used to reduce the impact where the discharge will be. Most Approvals will specify how much may be released and contain details on operation, testing, and reporting to the Department of the Environment.

c) Watercourse Alteration Regulation

Under this regulation persons or companies wishing to alter a watercourse by removing water or gravel, altering the pathway, installing a culvert or bridge, or filling in a watercourse must obtain a permit from the Minister of the Environment. Also, disturbance of the soil, including excavation or fill within 30 metres of a watercourse requires a permit. Effective May 1990, when the Clean Water Act is proclaimed a permit will be required for the cutting of any trees within 15 metres of a watercourse. As with the Water Quality Regulation a person must apply and if granted a permit it will state what may be done, how it is to be done, and if it is limited to a certain

time of the year ie. low flow or no fish migration.

d) Petroleum Storage Regulation

This regulation was introduced to reduce the pollution threat to ground and surface waters from tank storage of petroleum products by setting standards for new installations and by requiring removal of underground storage tanks by certain dates depending on when they were installed. The ultimate objective is to have tanks removed from service before rusting causes leaks and to have leak detection methods in place for systems that rust or otherwise fail before their permitted life expires. The regulation applies to tanks or groups of tanks having a capacity over 2000 litres (450 gallons). All such locations must be licensed under the regulation and all new tank installations must be done by licensed installers who have completed an approved training course. Above ground tanks are not subject to the same limited lifetime but must meet other requirements to insure they do not present a threat.

6) Pesticides Control Act - General Regulation (Administered by NB Dept of the Environment)

The Act regulates the manner in which pesticides are transported, stored, handled, used, and disposed of in the province. Specifically all vendors of Commercial and Restricted Class products must be licensed. Present regulations deal primarily with the requirements of the storage structure. A Permit, as reviewed by the Pesticides Advisory Board and issued by the Minister, is required for all aerial applications, applications to water and ground applications under contract agreement. Each Permit contains specific terms, conditions, and restrictions for the application of products and can only be carried out by a company that holds an Operator's Licence. In addition, all employees (applicators) must be qualified (Certified) for that specific type of application of pesticides. Presently, applications by ground to one's own property are exempted from having to have a permit and from having to be carried out by Certified Applicators.

All Licences and Certificates are renewed on an annual basis. The Pesticides Advisory Board can revoke Vendor Licences, Operator Licences and Applicator Certificates. Inspectors under the Act can place a verbal Stop Order on any handling of pesticides considered to be dangerous to health of people or animals or harmful to soil or plant life. The Minister can prohibit the sale, supply or use of any registered product and can remove any individual from an exemption under the Act.

7) Health Act (Administered by NB Dept of Health and Community Services)

The Health Act covers a wide variety of topics but only a few areas directly related to environmental pollution for which the Department continues to have primary responsibility. One major area is the approval of on site sewage disposal systems (homeowner septic tank/tile fields). The Department issues approvals for new systems and investigates problems reported with existing systems. Related to septic tanks is the Department licencing of any septic tank pump out businesses. The Department also concerns itself with the safety of recreational swimming areas and tests the more popular ones during the summer season. If a danger to health or safety is determined by testing for bacteria or the Inspector determines there is some other danger existing, the Department has the power to close the area for swimming by "posting" it. The Department can also "post" communal drinking water springs if a danger is present. A variety of other less frequent problems can be dealt with under the general "nuisance" provisions of the Act if they present a threat to health.

APPENDIX 3 - LISTING OF POTENTIAL SOURCES OF POLLUTION

Industrial Group	
Ashley Colter Sawmill	Boiestown
Russell & Swim Sawmill	Doaktown
Blackville Lumber	Blackville
North Shore Cedar	Blackville
Miramichi Pulp & Paper Sawmill	Nelson-Miramichi
Burchill Sawmill	Nelson-Miramichi
Atlantic Wafer Board	Chatham
Miramichi Pulp & Paper (Groundwood Mill)	Nelson-Miramichi
Miramichi Pulp & Paper (Kraft Mill)	Newcastle
Domtar Runoff (2 sites)	Newcastle
Chatham Industrial Park (Storm Sewers)	Chatham
Miramichi Pulp & Paper (Bark Dump)	Newcastle
Miramichi Pulp & Paper (Bark Dump)	Nelson-Miramichi
Newcastle Wharf	Newcastle
Chatham Wharf	Chatham
Juniper Lumber	Juniper
J D Irving Sawmill	Deersdale
Heath Steel Mines	
NB Power (Lagoon and Solid Waste)	Chatham
Newcastle Lumber Inc.	Newcastle

Bulk Fuel Storage Group	
Irving	Boiestown
Irving	Newcastle
ESSO	Newcastle
Texaco	Chatham
Ultramar	Chatham
Solid Waste Disposal Group	
Strawberry Marsh Dump	Newcastle
Municipal Dump	Chatham
Municipal Dump	Blackville
Municipal Dump	Doaktown
Municipal Dump	Nelson-Miramichi
Municipal Dump	Quarryville
Municipal Dump	Astle
Municipal Dump	Loggieville
Municipal Dump	Parker Road
Municipal Dump	Bellefond Road
Ramsay Dump	Bushville
Domestic Sewage Group	
Town of Chatham	Chatham
Village of Douglastown	Douglastown
Town of Newcastle	Newcastle
Village of Blackville	Blackville
Village of Doaktown	Doaktown
Miramichi Sewage Commission	Nelson-Miramichi
Village of Rogersville	Rogersville
Upper Miramichi Regional High School	Boiestown

Central New Brunswick Nursing Home	Boiestown
Miramichi Pulp & Paper	Newcastle
Village of Loggieville	Loggieville
KOA Campground	Loggieville
Eel Ground Indian Reserve	Eel Ground
Dungarvon Institution	Renous
The Enclosure Park	Newcastle
Atlantic Waferboard Ltd.	Chatham Head
Kerr Mobile Park	Chatham
MacTavish Mobile Home Park	Douglastown
Millerton Subdivision	Millerton
C.A. Clark Mobile Home Park	Douglastown
Astle Mobile Home Park	Millerton
Millerton High School	Millerton
Village of Nelson-Miramichi	Chatham Head
CFB Chatham	Chatham
CIBA-Geigy Canada Ltd.	Chatham
David Curtis Mobile Home Park	Chatham
North and South Esk Regional High School	Sunny Corner
Miramichi Pulp & Paper (Groundwood Mill)	Nelson-Miramichi
Miramichi Pulp & Paper (Kraft Mill)	Newcastle
Maritime Mobile Home Park	Chatham
Baie Ste. Anne School	
Elementary School	Blackville

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